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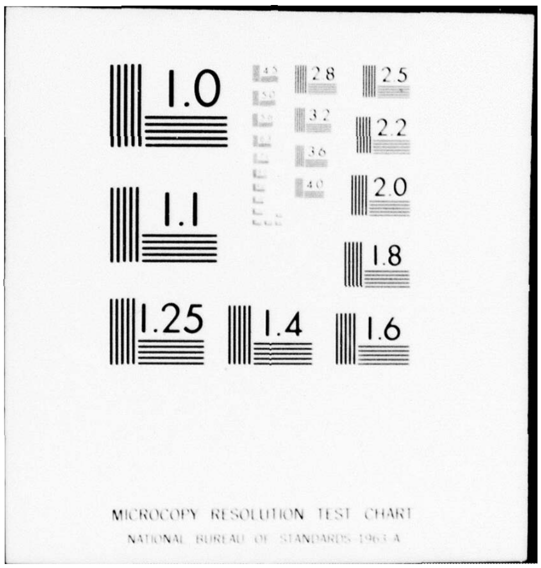
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TECHNICAL REPORT H-78-10

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NAVIGATION CONDITIONS, SUCK BEND REACH, CHATTAHOOCHEE RIVER ALABAMA AND GEORGIA.

Hydraulic Model Investigation.

14 WES-TR-H-78-10

by

10 Bertrand K. Melton, John J. Franco

Hydraulics Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Suck Bend Reach of the Chattahoochee River is in the upper end of Columbia Lock and Dam Pool about 1.5 miles downstream of the Walter F. George Lock and Dam. Suck Bend is essentially two adjacent and alternate bends in the form of a relatively flat "S" curve. Shoaling that occurs in the bend during flood flows and at times during powerhouse operation has been a problem for navigation when there is little or no flow from upstream. cont

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20. ABSTRACT (Continued).

cont

A movable-bed model reproducing about 1.5 miles of the Chattahoochee River to an undistorted scale of 1:72, model-to-prototype, was used to develop plans that would eliminate or reduce shoaling sufficiently to permit uninterrupted navigation and to improve navigation conditions for larger tows through the bend and in the approach to the proposed State Highway 10 bridge. The results of this investigation indicated the following:

a. Navigation conditions in Suck Bend are affected by shoaling of the channel in the bend, elevation of bedrock, and adverse currents.

b. Shoaling in the bend can be eliminated with training structures but the structures would not provide satisfactory navigation conditions through the bend and in the approach to the proposed State Highway 10 bridge for the larger tows because of the limited channel width and adverse currents.

c. Satisfactory navigation conditions could be provided with training structures and with excavation and filling along the right bank in the bend to eliminate the irregularities in the bank line and increase the radius of curvature of the channel in the lower bend.

d. Downbound tows of the larger size (435 ft by 78 ft) would have to flank to become properly aligned for passage through the bridge span even with the realigned right bank because of the short approach to the bridge after making the turn in the lower bend.

e. The alignment of the currents through the proposed bridge could be improved with vane dikes along the left side of the channel upstream of the bridge but the dikes would reduce the maneuver area available and could be a navigation hazard.

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PREFACE

The model investigation reported herein was authorized by the Office, Chief of Engineers, in an endorsement dated 6 April 1972 to the Division Engineer, U. S. Army Engineer Division, South Atlantic. The study was conducted for the U. S. Army Engineer District, Mobile, by the U. S. Army Engineer Waterways Experiment Station (WES) during the period May 1972 to March 1974.

During the course of the study, the Mobile District was kept informed of the progress of the study through monthly reports. In addition, Messrs. Allen W. Kerr, B. W. Odom, J. I. Meredith, and A. J. Pruett of the Mobile District visited WES at intervals to observe model tests and discuss test results.

The investigation was conducted in the Hydraulics Laboratory under the general supervision of Mr. H. B. Simmons, Chief of the Hydraulics Laboratory, and under the direct supervision of Mr. J. J. Franco (retired), Chief of the Waterways Division, and Mr. J. E. Glover, Chief of the Potamology Branch. The engineer in immediate charge of the model was Mr. B. K. Melton, assisted by Mr. T. J. Pokrefke and Mr. Ray H. Emerson. This report was prepared by Messrs. Melton and Franco.

Directors of WES during the course of this investigation and the preparation and publication of this report were BG Ernest D. Peixotto, CE, COL G. H. Hilt, CE, and COL John L. Cannon, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
miles (U. S. statute)	1.609344	kilometres
cubic yards	0.7645549	cubic metres
cubic feet per second	0.02831685	cubic metres per second
feet per second	0.3048	metres per second
degrees (angular)	0.01745329	radians

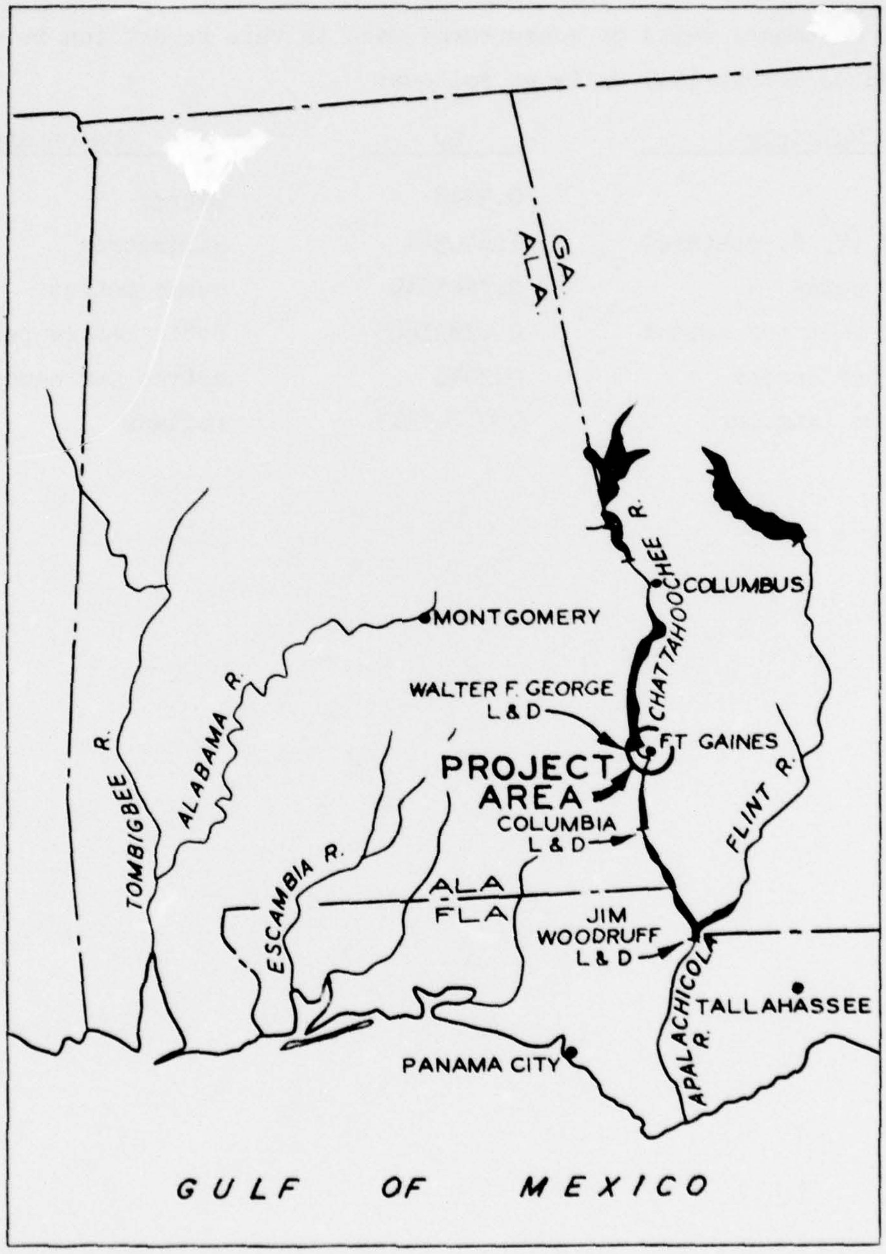

Figure 1. Vicinity map

NAVIGATION CONDITIONS, SUCK BEND REACH, CHATTAHOOCHEE RIVER, ALABAMA AND GEORGIA

Hydraulic Model Investigation

PART I: INTRODUCTION

1. The Chattahoochee River forms the boundary between the states of Alabama and Georgia and provides navigation facilities for parts of both states from Columbus, Georgia (Figure 1), to the Apalachicola River, then into the Gulf of Mexico. An authorized 9-ft* navigation channel extends from the Gulf of Mexico through the Jim Woodruff Lock and Dam, the Columbia Lock and Dam, and the Walter F. George Lock and Dam to Columbus, Georgia. A minimum 100-ft-wide navigation channel is maintained throughout the waterway.

2. Suck Bend, which consists essentially of two adjacent and alternate bends, is located at about river mile 73.6** on the Chattahoochee River approximately 1.5 miles below the Walter F. George Lock and Dam in the upper reach of the Columbia Lock and Dam Pool which has a normal pool elevation of 102.† Discharge through the Walter F. George Dam is normally limited to powerhouse releases 5 days per week except from December to May, the normal flood season, when all flows above upper pool el 185 pass uncontrolled through the spillway. Powerhouse releases vary during the day from 0 to 29,000 cfs.

The Problem

3. The Suck Bend Reach of the Chattahoochee River has been a problem area since the completion of the navigation channel. Severe shoaling has occurred in Suck Bend during flood stages and to a lesser degree

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* A table for converting U. S. customary units of measurement to metric (SI) units is given on page 3.
** River miles are above the mouth of the Chattahoochee River.
† All elevations (el) are in feet referred to mean sea level (msl).

during low stages with normal powerhouse releases. The shoal has been removed after each flood period by dredging. This dredging was required one or more times each year from 1965 through 1972 in quantities varying from 8,000 to nearly 40,000 cu yd annually. Normally there is sufficient depth for navigation during powerhouse operation, which is from 7:00 a.m. to 11:00 p.m., Monday through Friday. It is difficult and sometimes impossible for tows to schedule their arrival at this location during periods of operation. On weekends special arrangements for water releases have been made to allow tows to pass over the shoal.

Need for and Purpose of Model Study

4. Developments within an alluvial stream and the sedimentation processes involved depend on many factors, most of which are interrelated. The Suck Bend Reach is also affected by the elevation and configuration of bedrock near the surface of the bed, irregularities in the right bank line in the bend, and the sharp reverse turns in alignment of the channel. Because of the complex nature of the reach and the factors affecting its development, an analytical solution to the problem would be extremely difficult and uncertain. Therefore, a model study was considered necessary to determine the effectiveness of various plans proposed for the reach; to develop modifications required to eliminate or reduce shoaling in the bend; and to improve navigation conditions for larger tows through the bend and the approach to the bridge just downstream.

PART II: THE MODEL AND ITS VERIFICATION

Description

5. The model of Suck Bend was a scale reproduction of a short reach of the Chattahoochee River extending from river mile 72.9 to mile 74.4 (Figure 2) including sufficient overbank area to permit overbank flow to approximately 40 ft above the normal pool elevation of 102. The model was built to an undistorted linear scale of 1:72, model-to-prototype. The model was of the movable-bed type with fixed banks and the channel bedrock molded in sand-cement mortar (Figures 3 and 4). The bed material was coal which had a median grain diameter of about 2 mm and specific gravity of 1.31.

6. The fixed banks of the model were molded in accordance with data shown on survey maps dated December 1952. The bedrock was molded to conform with limited dredging and boring survey data of July 1963, partially revised to data of January 1973. The initial contour of the movable bed of the model was in accordance with the configuration shown in Plate 1, based on the July 1972 after-dredging survey. The piers and protective fenders of the proposed Alabama State Highway 10 bridge were included in the model based on plans submitted.

Appurtenances

7. Water was supplied to the model by a centrifugal flow pump operating in a circulating system and was measured at the upper end of the model by means of two venturi meters of different sizes required to handle the range of discharges. Water-surface elevations throughout the model were measured with point gages. Tailwater elevations at the lower end of the model were controlled with an adjustable tailgate. Soundings in the model were obtained by the use of a sounding rail and a special sounding rod that permitted the reading of elevations in prototype feet referred to msl. Bed material was measured in a graduated container and introduced manually at the upper end of the model. A sediment trap was

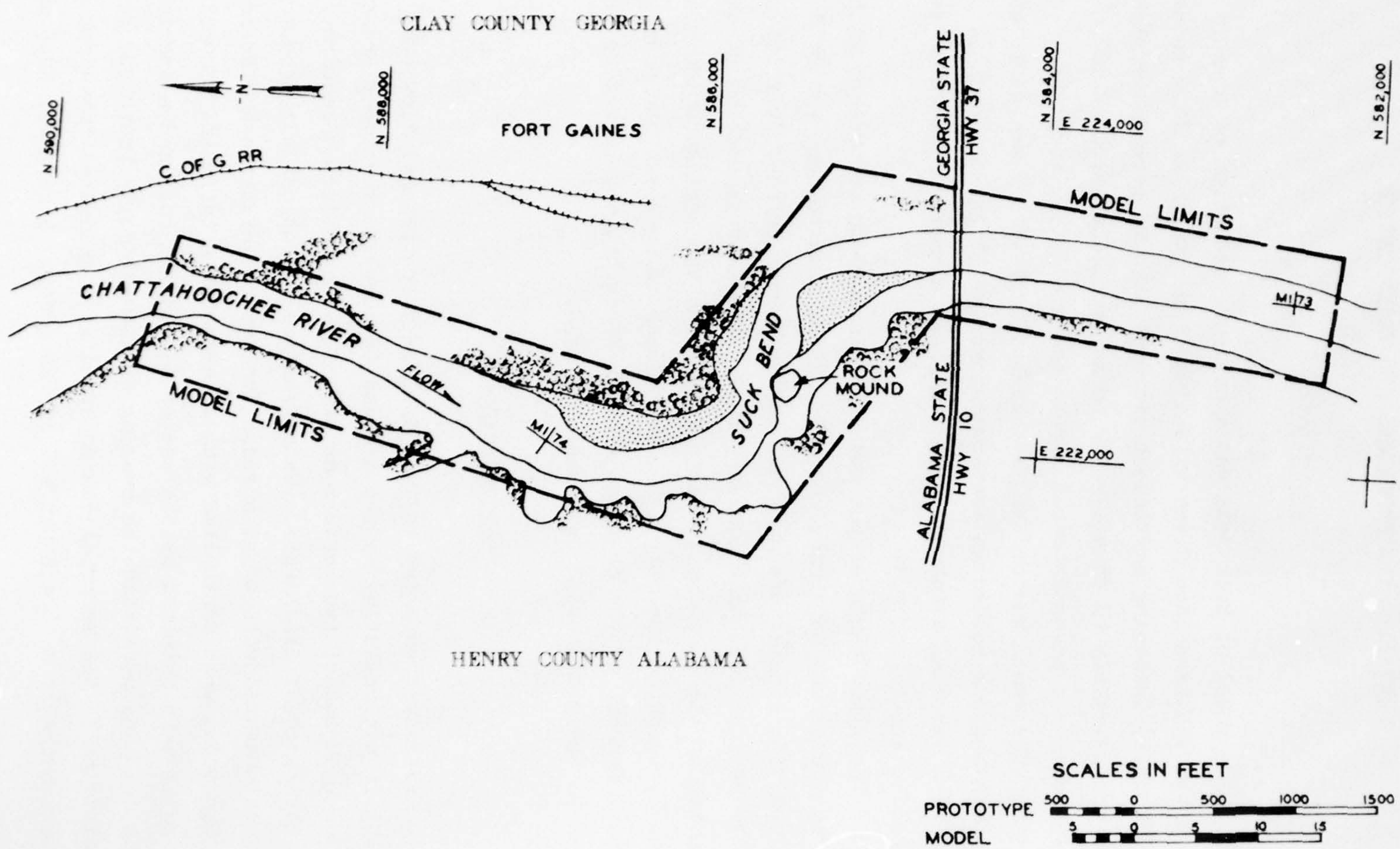


Figure 2. Suck Bend Reach model limits

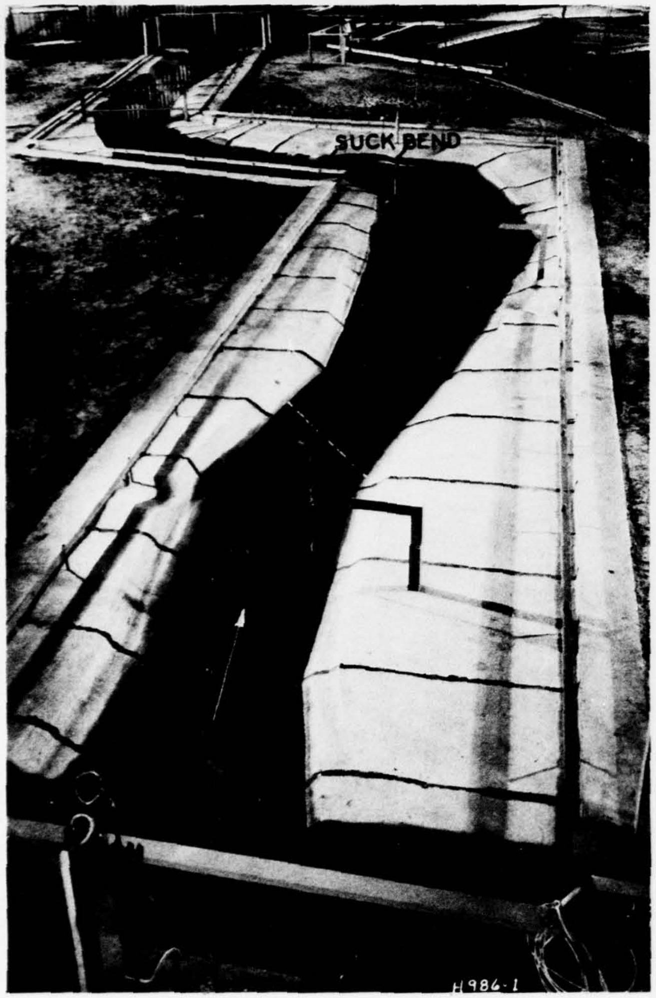


Figure 3. General view of model

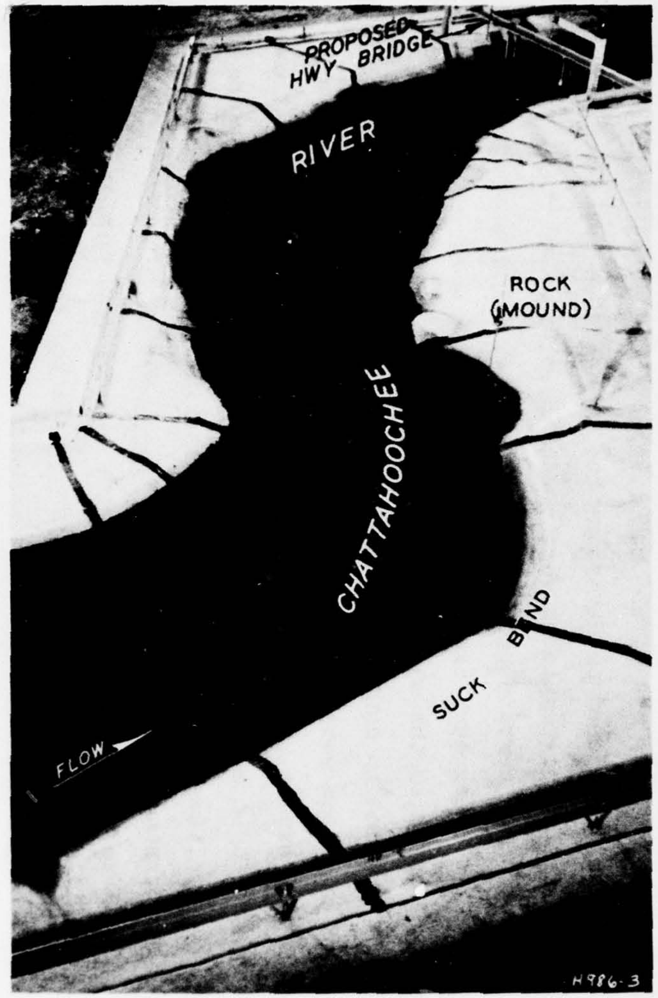


Figure 4. Model reproduction of Suck Bend

provided at the lower end of the model where extruded material could be accumulated and measured to determine the amount discharged for any period. Sheet metal templates were used for molding the model prior to the initiation of certain tests. A row of carefully graded iron rails was installed along each bank of the channel to support templates and the rail from which the model was surveyed, to control the grade of dredged cuts, and to control the grade of structures during installation. Current directions were determined by plotting the paths of wooden floats with respect to ranges established for that purpose; the floats were submerged to a depth of 9 ft, equivalent to the draft of a loaded barge. Velocities were determined by measuring the travel time of floats over known distances.

8. A radio-controlled tow and towboat equipped with screw-type propellers were used to study and demonstrate the effects of currents and channel alignment on navigation through the bends and in the bridge approach. The towboat could be made to run in forward or reverse and at various speeds comparable to those of towboats which travel the Chattahoochee River.

Model Verification

Principle involved

9. Before a movable-bed model can be used to determine the effectiveness of proposed improvement plans, its ability to reproduce conditions similar to those expected in the prototype must be demonstrated. Because of various dissimilarities between model and prototype, the degree of reliability of this type of model cannot be fully established by mathematical analysis and must be based on model verification. Verification of the model involves the adjustment of the various hydraulic forces, time scale, rate of introducing bed material, and model operating technique until it reproduces with acceptable accuracy the changes known to have occurred in the prototype during a given period. The verification would establish the various scale relations and model operating procedure and indicate the degree of similitude that could be expected.

Flow conditions

10. In order to reproduce developments in the model comparable to those which occurred in the river, it is necessary that the model reproduce flow conditions affecting developments in the river similar to those which occurred in the river. Since flow in the river was mostly intermittent based on powerhouse releases, it was not practical to reproduce the flows exactly as they occurred because of the short time scale relation between model and prototype. Accordingly, a composite hydrograph was developed based on prototype discharge data covering a period of 1 year. This hydrograph, shown in Plate 2, indicates the cumulative time when there was flow through the powerhouse and over the spillway sufficient to affect movement of bed material during the year. The water-surface elevations for the flows reproduced were based on data obtained at the proposed State Highway 10 bridge located about 1200 ft downstream of the problem area.

Model adjustment

11. Adjustment of the model was started with the movable bed molded to the after-dredging survey of July 1972 (Plate 1) and the model was operated by reproducing the flow hydrograph shown in Plate 2. During the operation, the rate of introducing bed material in the upper end of the model, the discharge scale relationship, and the time scale ratio were varied until the model reproduced generally the conditions indicated by the partial surveys of April 1969, August 1969, and March 1971 shown in Plate 3. These were the only surveys available for comparison with the model results.

Results

12. The results of the final adjustment and verification test, shown in Plate 3, indicate that the configuration of the model bed in the problem area was similar in location, area of shoaling, and height of shoal to that of the various prototypes in before-dredging surveys, also shown in Plate 3. Except for the survey of July 1972, no other prototype surveys covering the reach upstream and downstream of the problem area were available for comparison with the model. Based on the July 1972 prototype survey, the model indicated a somewhat greater

tendency for shoaling of the channel upstream of the problem area and greater shoaling along the right bank downstream.

13. The results obtained during the verification tests indicated that the model reproduced the problem in Suck Bend and the general characteristics of the stream with sufficient accuracy to permit the study of various proposed improvement plans. However, the greater tendency for the model to shoal in the reaches above and below the problem area should be considered in the evaluation of the results.

PART III: TESTS AND RESULTS

Test Procedure

14. Tests were concerned with the development of plans designed to eliminate or reduce shoaling in Suck Bend sufficiently to permit continuous navigation during periods of little or no flow from upstream and to improve navigation conditions, particularly for larger tows. Most of the plans tested were preliminary in nature and are not covered in this report since the results were used to develop some of the basic plans that appeared to produce favorable results.

15. Tests of plans were started with the bed of the model molded to the conditions indicated by the July 1972 prototype survey (Plate 1) or with the model bed as obtained at the end of the preceding test. Tests of the basic plans were started with the bed molded to conform to the prototype survey and comprised two reproductions of the hydrograph shown in Plate 2. Current directions and velocity measurements were obtained at the end of some of the tests, and navigation conditions were determined with the model towboat and tow having a length of 435 ft and width of 78 ft (prototype).

Preliminary Tests

16. Plans A to F were designed to provide some general information on the effectiveness of various dike systems and the results were used to develop Plan G. In the preliminary tests the location, number, length, alignment, and elevations of rock dikes were varied to determine their relative effectiveness.

Plan G

Description

17. Plan G was based on the results of the preliminary tests and included four rock dikes along the left bank upstream of the first bend

and two dikes along the right bank in the vicinity of the second bend as shown in Plate 4. Along the left bank, the two dikes farthest upstream were angled about 50 deg toward the downstream and the other two were placed normal to the channel alignment. Elevations of the crest of the left bank dikes were at 107 for the upper dike and at 110 for the remaining dikes downstream. The lengths of the dikes were 250, 240, 210, and 140 ft from upstream to downstream.

18. The upper right bank dike was angled toward the downstream extending from the Rock Mound and then angled to the left (riverward) about 40 deg. The crest of the dike sloped from el 112 at the bank end to el 107 at its river end. The second right bank dike was 220 ft long with its crest sloping from el 112 at the bank end to el 107 at the river end.

Results

19. The results shown in Plate 4 indicate a continuous channel through the entire reach of more than project width and depth. Scouring occurred just downstream of the third left bank dike from upstream and the material scoured was deposited between the third and fourth dike and below the fourth dike. The depth of scouring and its effect on the stability of the dike would depend on the elevation and nature of the bed rock downstream of the dike.

20. In general, the test results of this plan indicate that the structures included in Plan G would be effective in eliminating shoaling in Suck Bend under the conditions tested. Comparison of the results of this test and those of the verification test also indicates considerable improvement in the channel upstream and downstream of the problem area.

Plan I

Description

21. Plan H was a preliminary plan designed to determine the effectiveness of modifications in the left bank dike system of Plan G that would eliminate or reduce the scouring on the end of the third dike from upstream. Plan I, based on the results of the preliminary test of

Plan H, was the same as Plan G except for the following (Plate 4):

a. A dike was added along the left bank between the third and fourth dike from upstream of Plan G. The dike was 225 ft long with top at el 110.

b. The lower dike on the right bank was eliminated.

Results

22. The results shown in Plate 4 indicate that most of the scouring at the end of the third dike along the left bank noted in the Plan G test was eliminated and a reasonably good channel was maintained through the entire reach. Tests with the model towboat and tow indicated that a 435- by 78-ft tow would experience considerable difficulty in navigating the reach because of the sharp turns and the additional channel width required by the tow in negotiating the turns.

Plan J

Description

23. Plan J was the same as existing conditions except for excavation along the right bank from just above Rock Mound to just upstream of the proposed State Highway 10 bridge (Plate 5). The excavation, which included the removal of Rock Mound, had a bottom elevation of 92 and was designed to increase the width and radius of the channel through the lower bend.

Results

24. The results of the test of Plan J, shown in Plate 5, indicate extensive shoaling along the left side of the excavated area and in the channel to the left of the excavation. There was also considerable shoaling in the channel upstream compared with the results of tests of Plans G and I.

Plan L

Description

25. Plan K was a preliminary plan tested to determine structures and modifications that would be effective in developing a satisfactory channel through the reach with the excavation of Plan J. The results of

Plan K were used to develop Plan L which included four dikes along the left bank as shown in Plate 5. The upper three dikes were the same as the first, second, and fourth dikes from upstream of Plan I with the addition of a 275-ft-long dike opposite the excavated area with crest at el 110.

Results

26. The results shown in Plate 5 indicate that the dikes included in this plan were effective in developing a channel of more than project width and depth through the entire reach. Scouring occurred at the end of the third dike along the left bank with some shoaling upstream of the dike and downstream of the scour hole. The attack on the dike and flow along the right bank produced irregular currents in the bend that could adversely affect navigation.

Plan P

Description

27. Plan P was based on preliminary tests of Plans M, N, and O designed to improve the alignment of the currents in the bend. This plan was the same as Plan L, except for the following (Plate 6):

a. An additional 50 ft was excavated along the right bank in the bend to el 92.

b. The fourth dike of Plan L opposite the excavation was lengthened to 290 ft and the top of the dike lowered to el 105.

c. A dike 200 ft long with top elevation of 110 was added between the third and fourth dike along the left bank.

Results

28. Results shown in Plate 6 indicate that a channel of more than project width and depth was maintained through the entire reach. The alignment of the channel through the lower bend was better than with Plan L, but there was little improvement in the alignment of the currents in the upper bend.

Plan S

Description

29. The features of Plan S were based on preliminary tests of Plans Q and R which were designed to improve currents through the bend observed with Plans L and P. This plan was the same as Plan P except for the following (Plate 7):

a. The third dike along the left bank from upstream was 225 ft long with top at el 110. The fourth dike was 225 ft long with top at el 115 and the fifth dike opposite the excavated right bank was 310 ft long with top at el 110.

b. The scallop in the right bank near the lower end of the upper bend was filled to el 110 with nonerodible material to form a smooth curve tying in with the excavated bank downstream.

c. The deep channel along the right bank in the upper bend was filled with nonerodible material to el 92 as shown in Plate 7.

Results

30. The results shown in Plates 7 and 8 indicate that a channel of more than project width and depth was maintained through the reach with considerable improvement in the alignment of the currents through the bends. The channel through the lower bend and downstream was somewhat wider than obtained with Plan P. Velocities of currents affecting navigation through the bends were generally moderate, varying between 3 and 4 fps with the 10,000- and 25,000-cfs flows and slightly higher with the 60,000-cfs flow (Plate 8). Currents were generally parallel to the bank lines except near the proposed State Highway 10 bridge where currents tended to move toward the left bank particularly during the lower flows. No navigation difficulties were indicated for tows up to a length of 435 ft and width of 78 ft. Because of the limited approach distance, downbound tows of the larger sizes would have to flank to maintain satisfactory alignment for passage through the bridge span after making the turn in the lower bend.

Plan T

Description

31. Plan T was designed in an effort to improve the alignment of currents through the proposed State Highway 10 bridge. The plan was the same as Plan S except that two vane dikes, each 150 ft long, were located along the left side of the channel downstream of the lower left bank dike (Plate 9). The dikes, which had a top elevation of 110, were placed at a slight angle to the alignment of the currents and spaced 150 ft apart.

Results

32. Results shown in Plates 9-10 indicate that the vane dikes were effective in diverting sediment toward the left bank and in improving the alignment of the currents approaching the bridge, particularly with the 10,000- and 25,000-cfs flows. Except for the deposition along the left bank near the vane dikes, the channel through the reach was about the same as with Plan S. Navigation conditions for downbound tows approaching the bridge were somewhat better, particularly with the lower flows. However, the larger tows would still have to flank to make a satisfactory approach to the bridge span and the vane dikes would limit the maneuver area available upstream of the bridge.

PART IV: DISCUSSION OF RESULTS AND CONCLUSIONS

Limitation of Model Results

33. The evaluation and interpretation of results from movable-bed model studies have to be based on the degree of similarity between model and prototype as indicated by the model verification. The conventional method of verifying models of this type was not possible in this study because of the lack of adequate prototype data. Because of the intermittent flow based on daily variations in powerhouse releases, it was not practical to reproduce in the model the discharges as they actually occur in the prototype. Developments in the reach were also affected by the configuration and elevation of bedrock which had to be reproduced in the model based on limited data.

34. The model was adjusted until it reproduced the shoaling problem in Suck Bend based on partial before-dredging surveys made during the period April 1968 to March 1971. In spite of the limitations mentioned above, the results of the final adjustment (verification test) indicated that the model was capable of reproducing the shoaling tendencies in Suck Bend and the general characteristics of the prototype stream with sufficient accuracy to permit the study of the proposed plans and to determine the relative effectiveness of the various plans.

35. Developments within the reach under study will depend to some extent on flow conditions and the rate of sediment movement in the reach. Since the verification test and tests of improvement plans were conducted with the same flow condition and rate of sediment movement, the effectiveness of an improvement plan should be based on a comparison of the results of the test of that plan with the results of the verification test.

Summary of Results and Conclusions

36. The following results and conclusions were indicated from the model study:

a. Navigation conditions in Suck Bend were affected by shoaling, configuration and elevation of bedrock, and adverse currents.

b. Shoaling in Suck Bend can be eliminated with training structures, but these structures would not provide satisfactory navigation conditions through the bend or in the approach to the proposed State Highway 10 bridge for larger tows without removing some of the irregularities in the alignment of the right bank.

c. Shoaling in Suck Bend could be eliminated with rock dikes along the left bank as in Plan I, but navigation conditions would tend to be hazardous for downbound tows because of adverse currents and sharp turns.

d. Satisfactory navigation conditions could be provided with rock dikes along the left bank and excavation and filling along the right bank to improve channel alignment as in Plan S. Even with this plan, large downbound tows would have to do some flanking because of the short approach to the bridge after negotiating the bend just upstream.

e. The addition of two vane dikes along the left side of the channel just upstream of the bridge as in Plan T would cause sediment to be deposited along the left bank and improve the alignment of the currents through the bridge span. However, the dikes would reduce the maneuver area available for downbound tows approaching the bridge after negotiating the bend upstream and could constitute a navigation hazard.

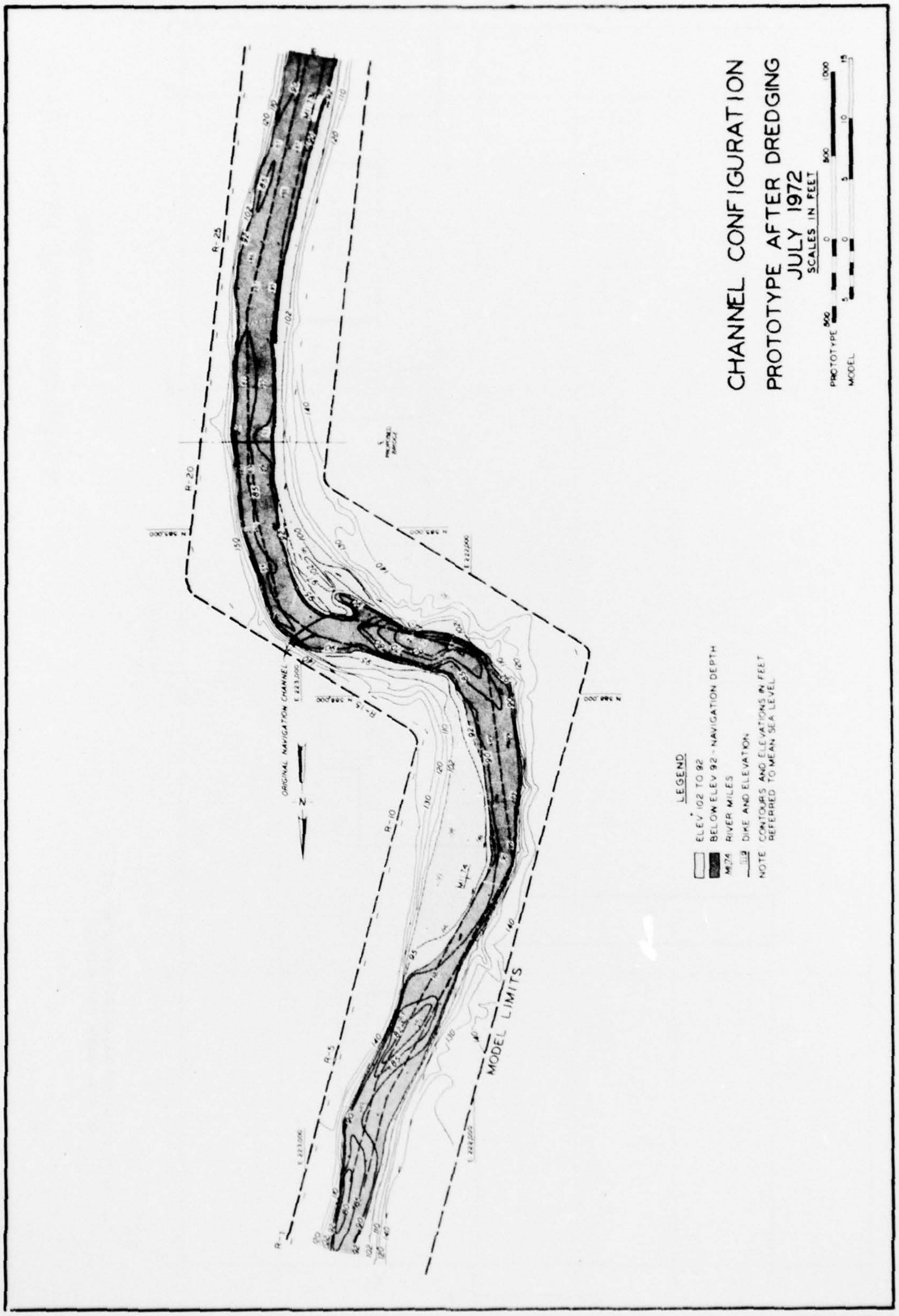
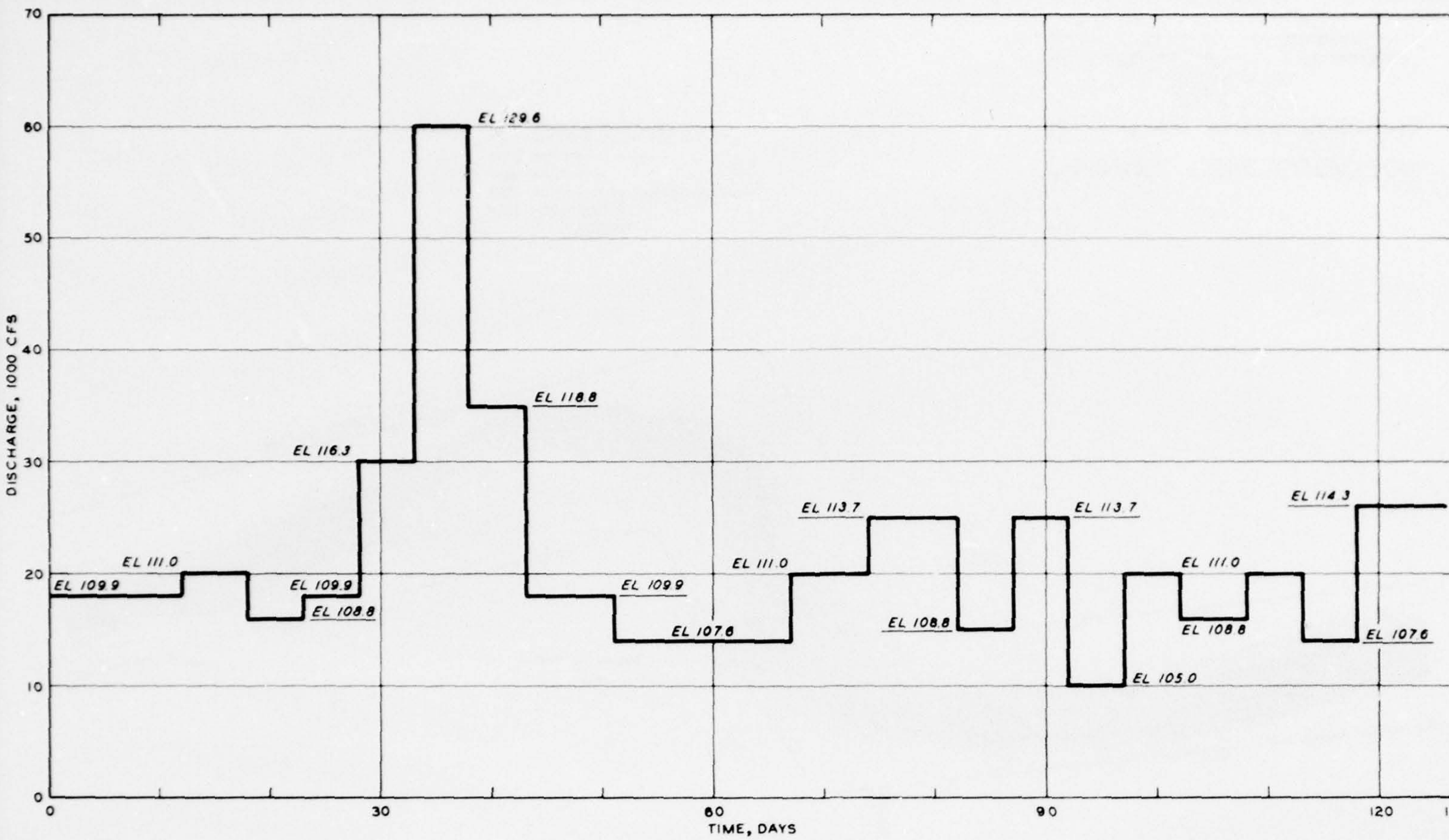

CHANNEL CONFIGURATION
PROTOTYPE AFTER DREDGING
JULY 1972
SCALES IN FEET
PROTOTYPE
MODEL
LEGEND
ELEV 102 TO 92
BELOW ELEV 92 - NAVIGATION DEPTH
RIVER MILES
DIKE AND ELEVATION
NOTE CONTOURS AND ELEVATIONS IN FEET REFERRED TO MEAN SEA LEVEL
ORIGINAL NAVIGATION CHANNEL
MODEL LIMITS

PLATE 1

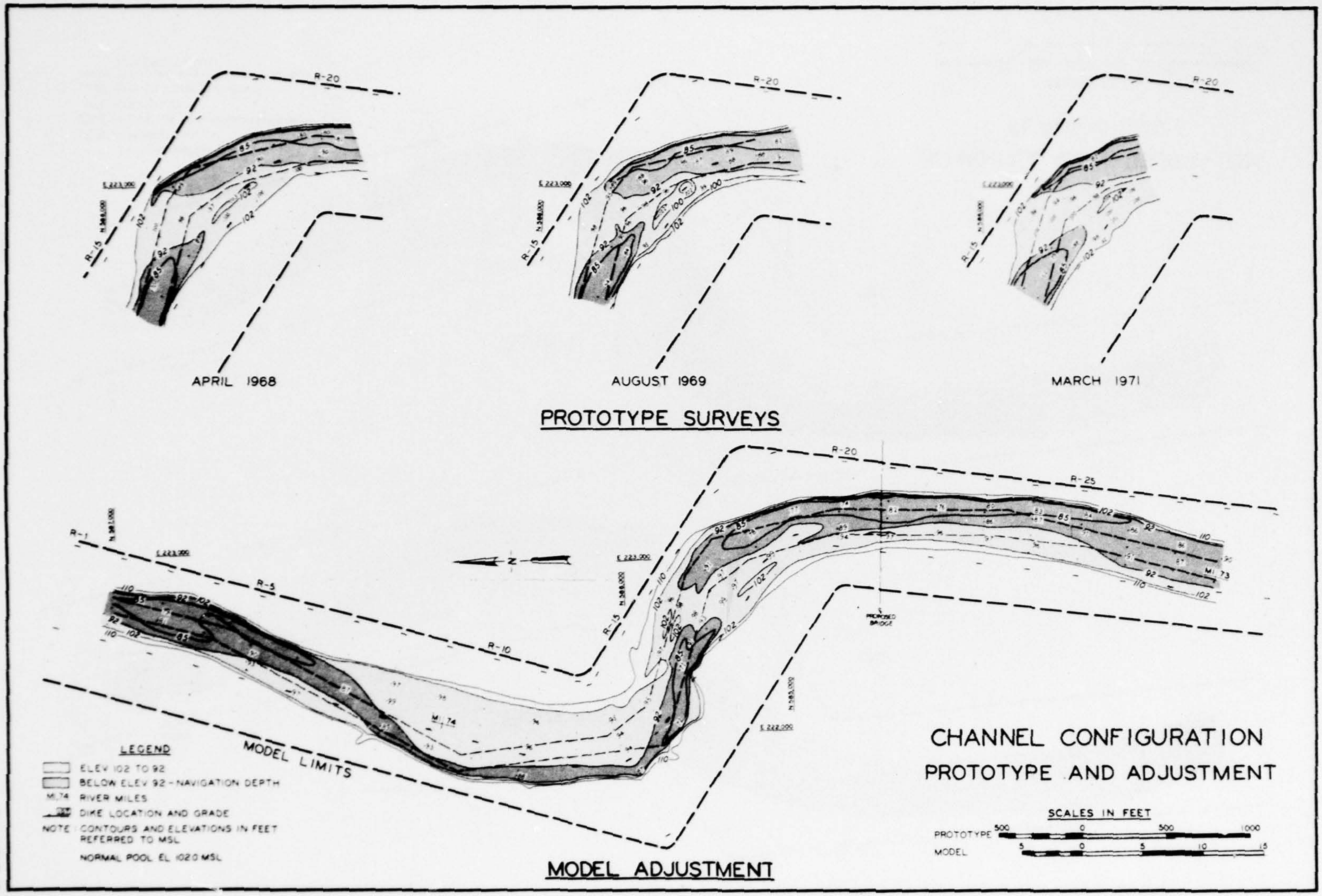
PLATE 2



NOTE: ELEVATIONS ARE WATER SURFACE IN FEET MSL AT ALABAMA HWY 10 BRIDGE

SUCK BEND

STAGE-DISCHARGE HYDROGRAPH


APRIL 1968
AUGUST 1969
MARCH 1971
PROTOTYPE SURVEYS
MODEL ADJUSTMENT
MODEL LIMITS
PROPOSED BRIDGE
CHANNEL CONFIGURATION
PROTOTYPE AND ADJUSTMENT
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 5 0 5 10 15
LEGEND
ELEV 102 TO 92
BELOW ELEV 92 - NAVIGATION DEPTH
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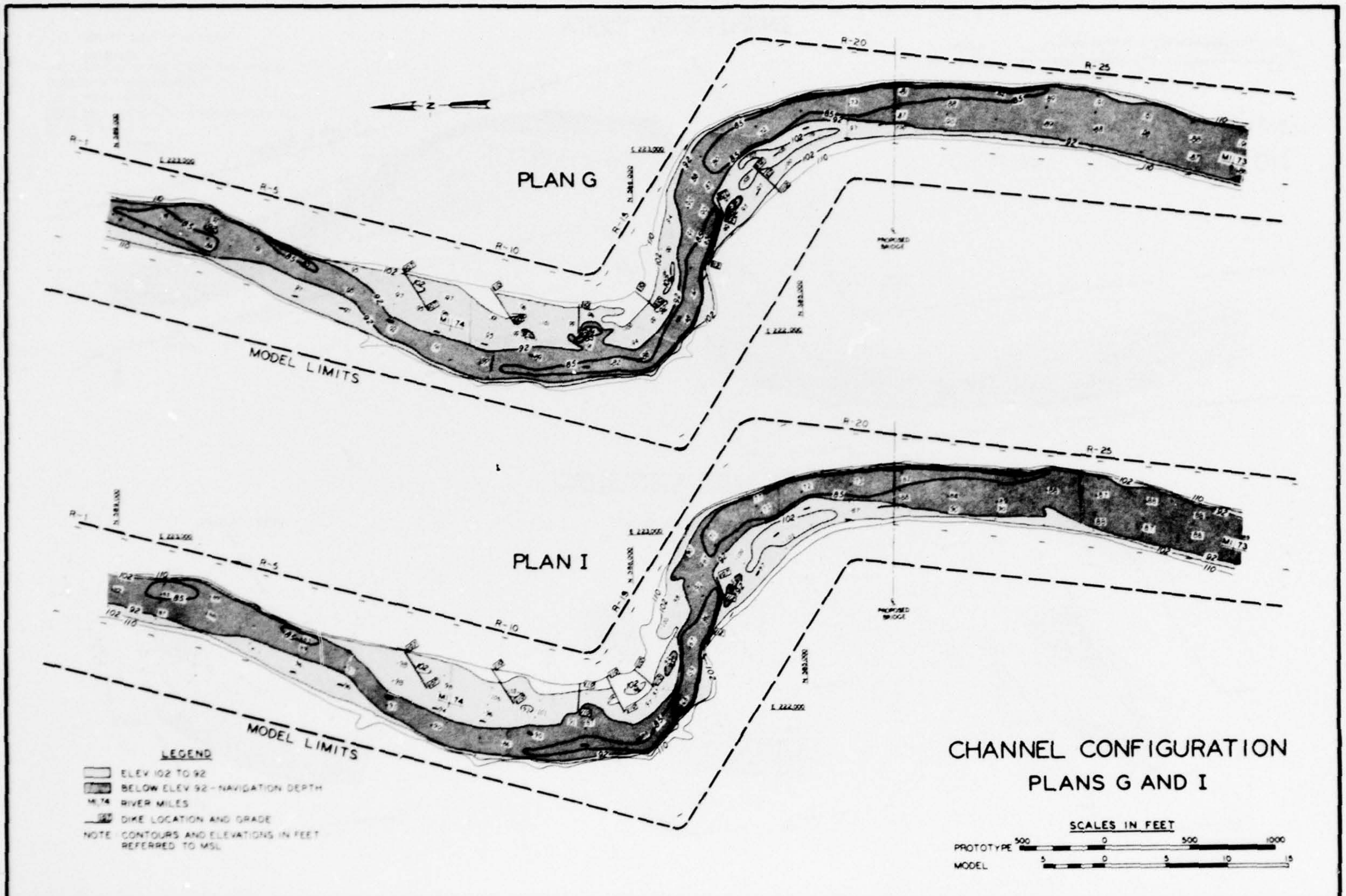
DIKE LOCATION AND GRADE
NOTE CONTOURS AND ELEVATIONS IN FEET REFERRED TO MSL
NORMAL POOL EL 102.0 MSL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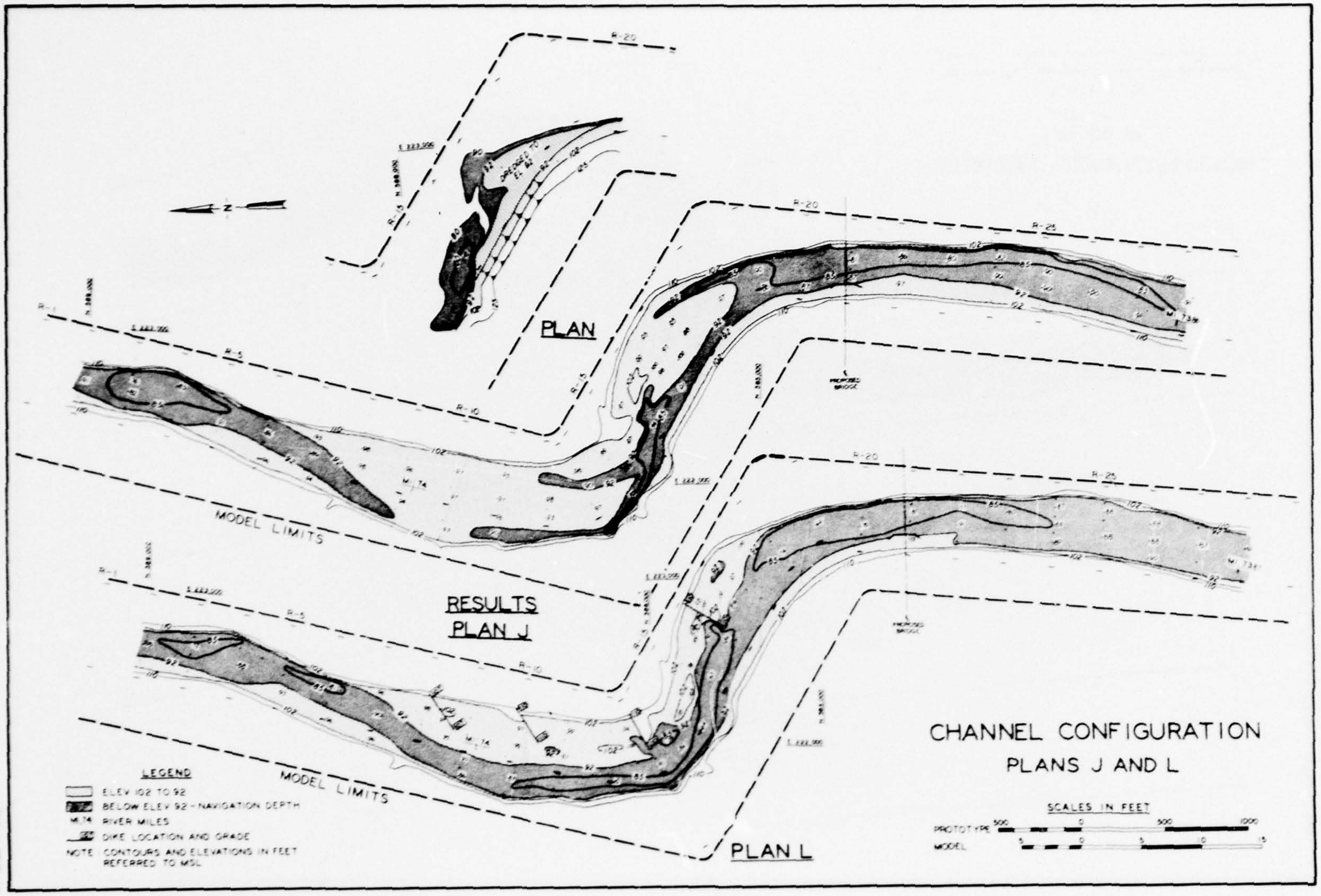
MI. 74 RIVER MILES
DIKE LOCATION AND GRADE
NOTE: CONTOURS AND ELEVATIONS IN FEET REFERRED TO MSL
CHANNEL CONFIGURATION
PLANS G AND I
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 5 0 5 10 15

PLATE 4



CHANNEL CONFIGURATION
PLANS J AND L
PLAN
RESULTS
PLAN J
PLAN L
MODEL LIMITS
MODEL LIMITS
R-1
R-5
R-10
R-15
R-20
R-25
DREDGED TO EL 84
PROPOSED BRIDGE
N 388,000
E 223,000
MI 74
LEGEND
ELEV 102 TO 92
BELOW ELEV 92 - NAVIGATION DEPTH
MI 74 RIVER MILES
DIKE LOCATION AND GRADE
NOTE: CONTOURS AND ELEVATIONS IN FEET REFERRED TO MSL
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 5 0 5 10 15

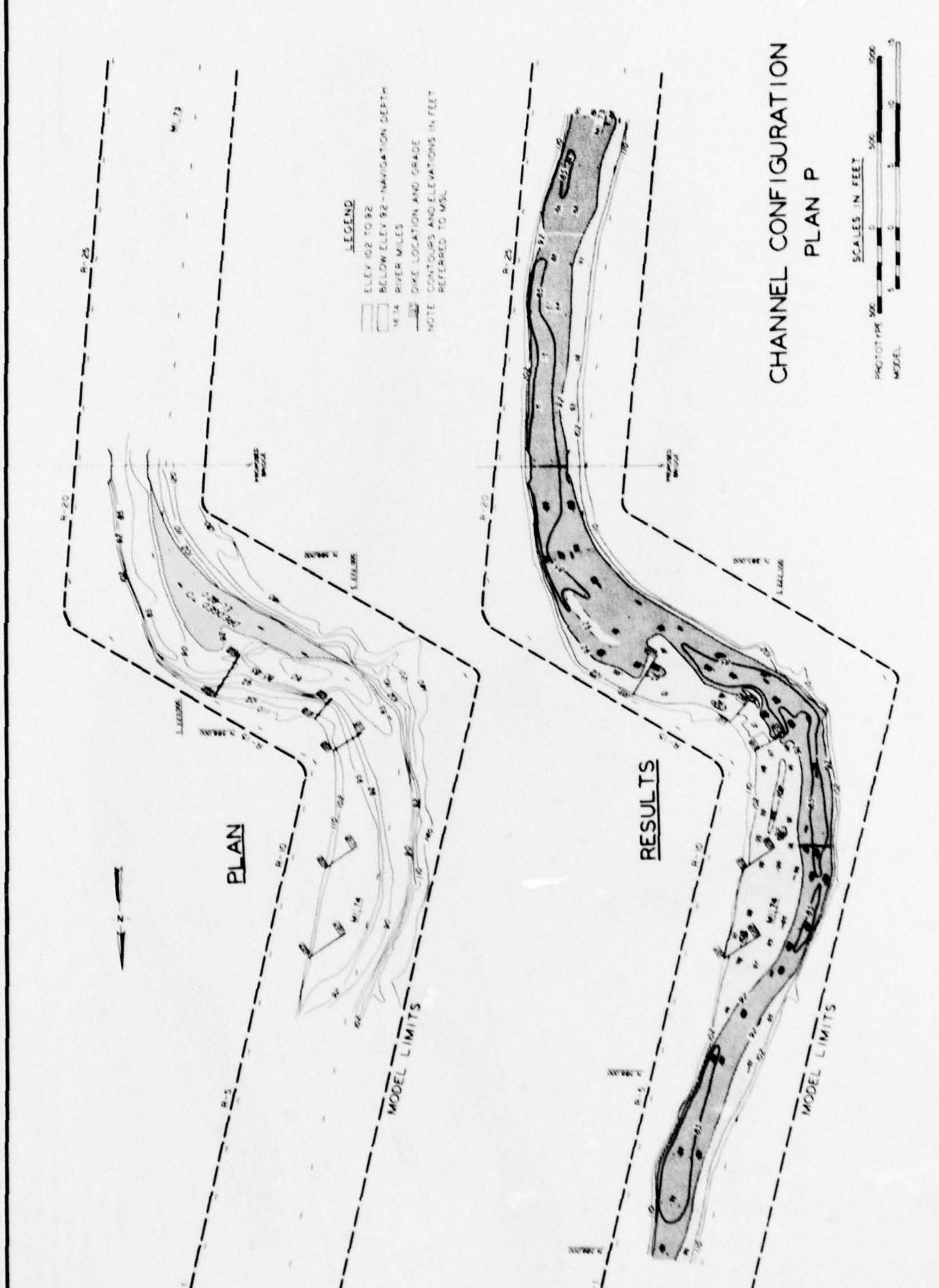
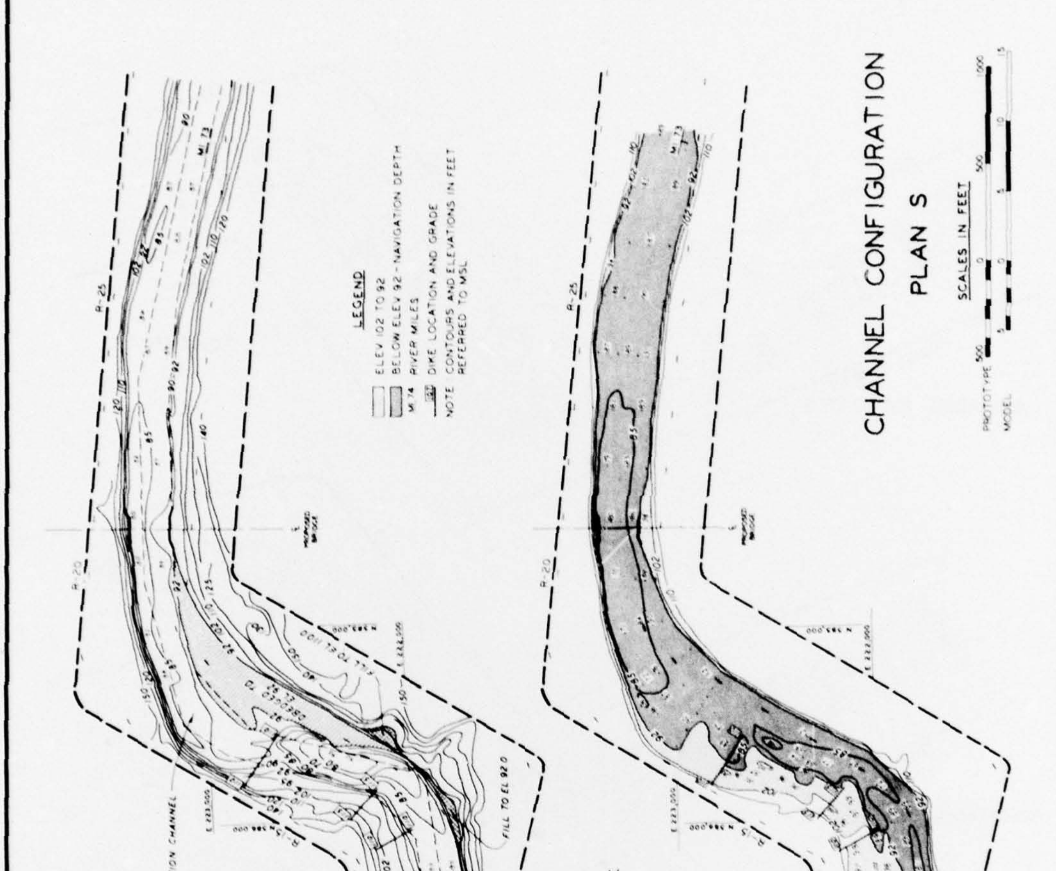
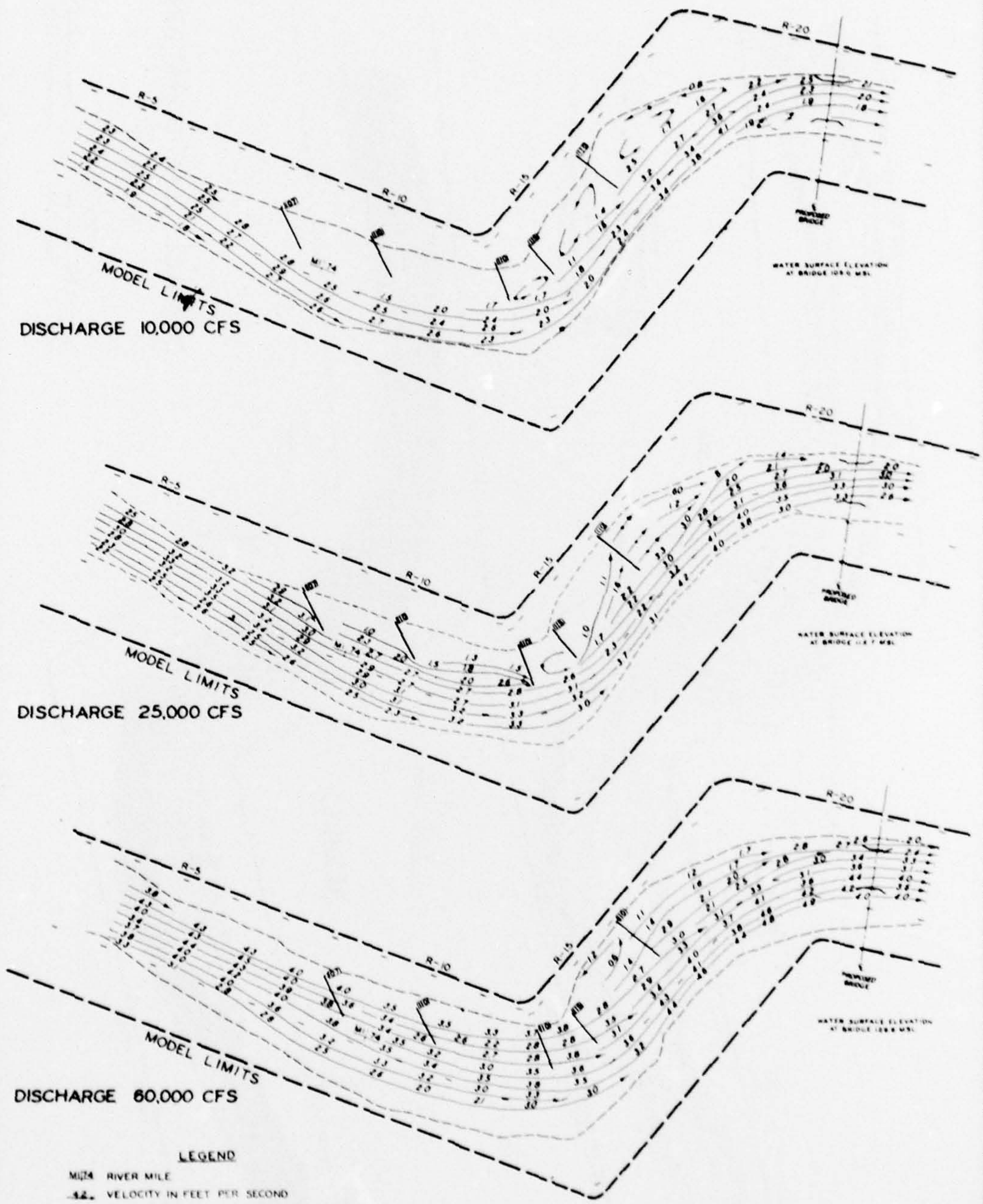

CHANNEL CONFIGURATION
PLAN P
PLAN
RESULTS
MODEL LIMITS
MODEL LIMITS
LEGEND
ELEV 102 TO 92
BELOW ELEV 92 - NAVIGATION DEPTH
RIVER MILES
DIKE LOCATION AND GRADE
NOTE: CONTOURS AND ELEVATIONS IN FEET REFERRED TO MSL
SCALES IN FEET
PROTOTYPE
MODEL

PLATE 6



CHANNEL CONFIGURATION

PLAN S



LEGEND

MI 174 RIVER MILE

4.2 VELOCITY IN FEET PER SECOND

VELOCITY LESS THAN 0.5 FEET PER SECOND

DIKE ELEVATION AND GRADE

NOTE: VELOCITIES AND CURRENT DIRECTIONS OBTAINED WITH FLOATS SUBMERGED TO DRAFT OF LOADED BARGE (9.0 FEET)

ALL ELEVATIONS IN FEET REFERRED TO MSL

SCALES IN FEET

PROTOTYPE 500 0 500 1000

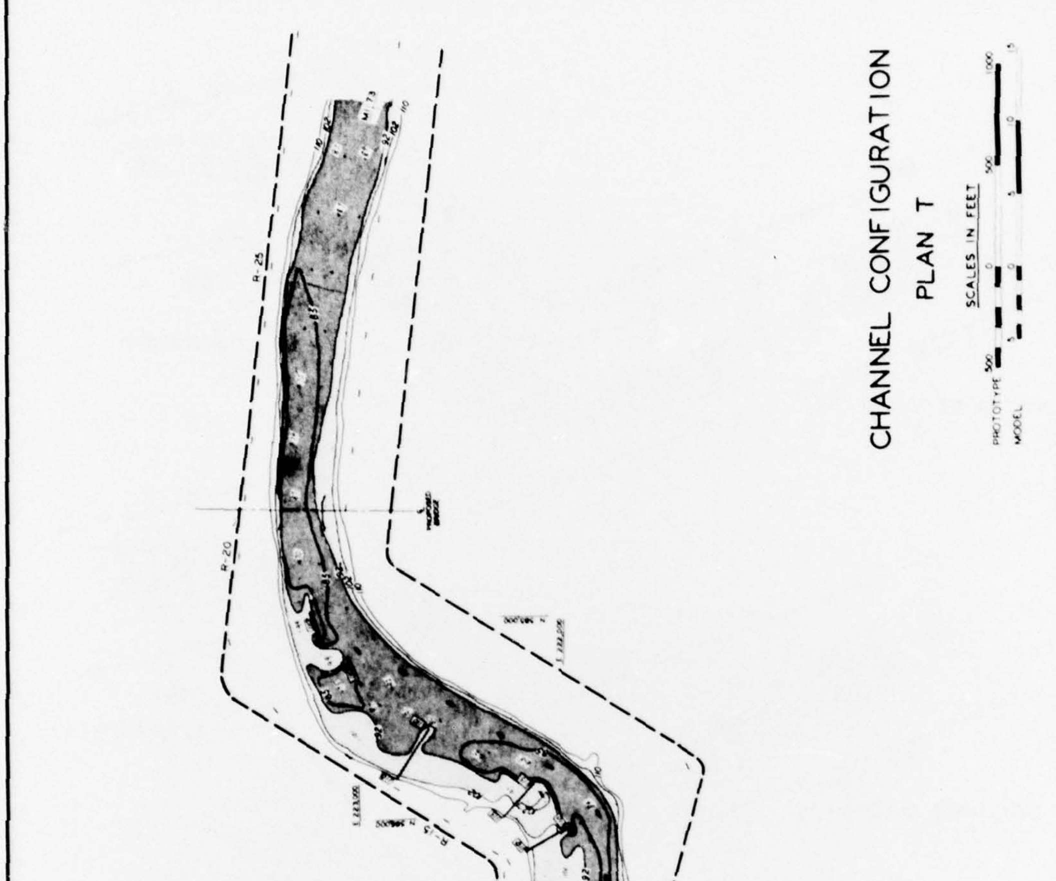
MODEL 5 0 5 10 15

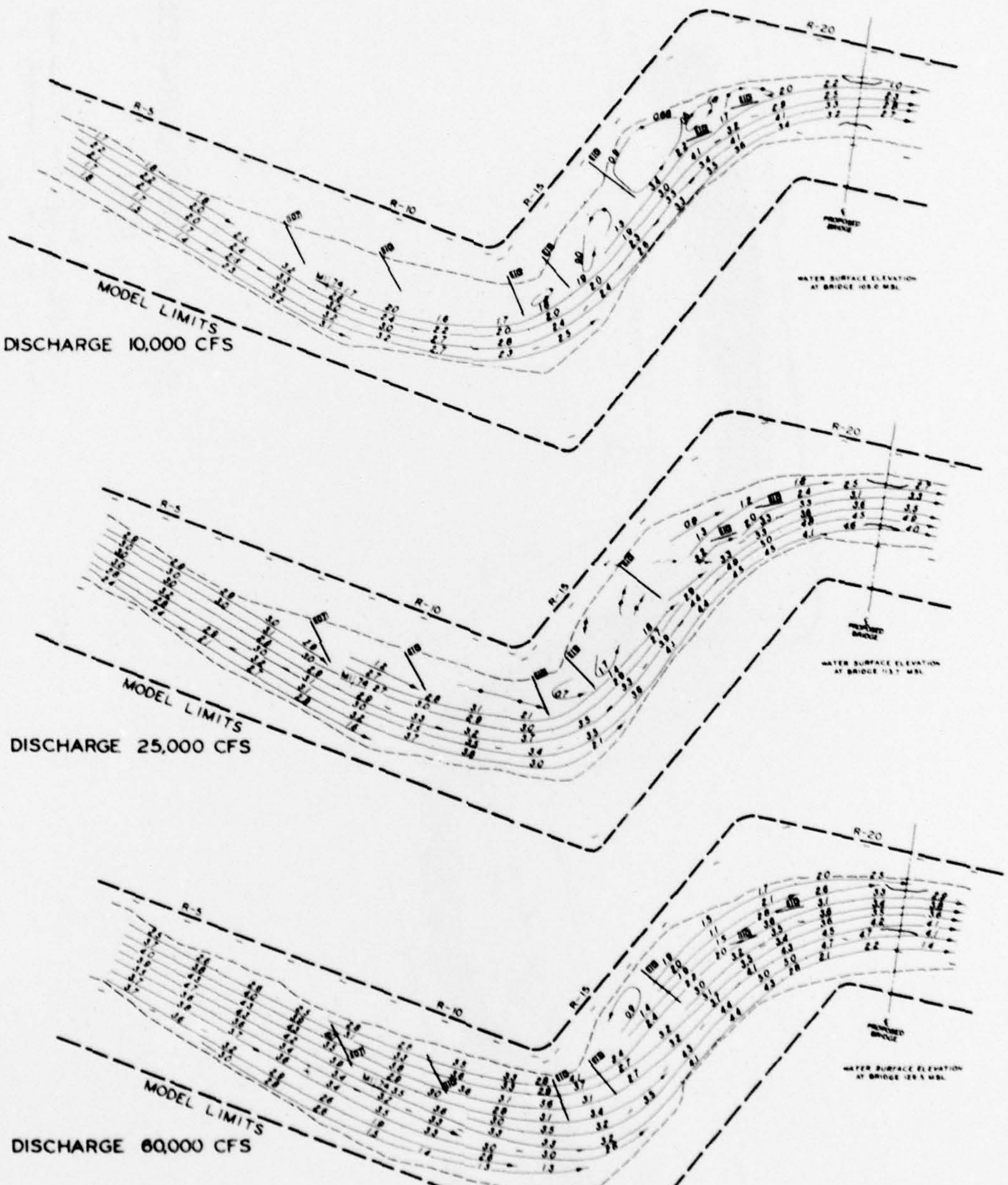
VELOCITIES AND CURRENT DIRECTIONS

PLAN S

DISCHARGES 10,000, 25,000, AND 60,000 CFS

PLATE 8


CHANNEL CONFIGURATION
PLAN T
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 5 0 5 10 15
LEGEND
ELEV 102 TO 92
BELOW ELEV 92 - NAVIGATION DEPTH
RIVER MILES
DIKE AND ELEVATION
NOTE: CONTOURS AND ELEVATIONS IN FEET REFERRED TO M.S.L.
MODEL LIMITS
R-1
R-5
R-10
R-15
R-20
R-25



LEGEND

- MI 174 RIVER MILE
- 4.2 VELOCITY IN FEET PER SECOND
- VELOCITY LESS THAN 0.5 FEET PER SECOND
- DIKE ELEVATION AND GRADE

NOTE: VELOCITIES AND CURRENT DIRECTIONS OBTAINED WITH FLOATS SUBMERGED TO DRAFT OF LOADED BARGE (9.0 FEET)

ALL ELEVATIONS IN FEET REFERRED TO MSL

SCALES IN FEET

PROTOTYPE 500 0 500 1000

MODEL 5 0 5 10 15

VELOCITIES AND CURRENT DIRECTIONS

PLAN T

DISCHARGES 10,000, 25,000, AND 60,000 CFS

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Melton, Bertrand K

Navigation conditions, Suck Bend Reach, Chattahoochee River, Alabama and Georgia; hydraulic model investigation / by Bertrand K. Melton, John J. Franco. Vicksburg, Miss. : U. S. Waterways Experiment Station : Springfield, Va. : available from National Technical Information Service, 1978.

20 p., 10 leaves of plates : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; H-78-10)

Prepared for U. S. Army Engineer District, Mobile, Mobile, Alabama.

1. Chattahoochee River. 2. Movable-bed models. 3. Navigation channels. 4. Navigation conditions. 5. Suck Bend, Chattahoochee River. I. Franco, John J., joint author. II. United States. Army. Corps of Engineers. Mobile District. III. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; H-78-10.

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